

Application No. 10/698,707
Amendment dated August 23, 2006
Reply to Office Action of May 23, 2006

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:
 - a light emitter for irradiating a line which extends along a width direction of said path with a slit ray;
 - an image capturing part for photographing said line to obtain an image;
 - a line data generator for generating one-dimensional line data indicative of an irradiation state of said slit ray on said line from the image obtained by said image capturing part;
 - a detection part for detecting said passing objects on the basis of said one-dimensional line data; and
 - a counter for counting said number of said passing objects on the basis of said line data detected by said detection part,
wherein said line data generator selects a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and sets said statistical representative value as a value of a pixel in said line data in the same position as each pixel column.
2. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:
 - a light emitter for irradiating a plurality of lines which extend along a width direction of said path and provided at intervals, respectively, with a plurality of slit rays;
 - an image capturing part for photographing said plurality of lines to obtain images;
 - a line data generator for generating a plurality of pieces of one-dimensional line

data each indicative of an irradiation state of each of said slit rays on said plurality of lines, respectively, from the images obtained by said image capturing part;

a detection part for detecting said passing objects on the basis of said plurality of pieces of one-dimension line data; and

a counter for determining travel directions of said passing objects on the basis of said plurality of pieces of one-dimensional line data, and counting said number of said passing objects detected by said detection part in each of the travel directions of said passing objects,

wherein said line data generator selects a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and sets said statistical representative value as a value of a pixel in said line data in the same position as each pixel column.

3. (Canceled)

4. (Canceled)

5. (Currently Amended) The counting system according to claim [[3]] 1, wherein

said statistical representative value includes the maximum value in the values of pixels in each pixel column.

6. (Currently Amended) The counting system according to claim [[3]] 1, wherein

said statistical representative value includes the maximum value in values each obtained by adding values of two neighboring pixels in each pixel column.

7. (Original) The counting system according to claim 1, further comprising:
an interruption data generator for comparing said line data with reference data indicative of a state of said line when said slit ray is not interrupted and generating one-

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dimensional interruption data indicative of a position in which said slit ray is interrupted on said line, wherein

said counter counts said number of said passing objects on the basis of said interruption data.

8. (Original) The counting system according to claim 2, further comprising:
an interruption data generator for comparing said line data with reference data indicative of a state of said line when said slit ray is not interrupted and generating one-dimensional interruption data indicative of a position in which said slit ray is interrupted on said line, wherein

said counter counts said number of said passing objects on the basis of said interruption data.

9. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:

a light emitter for irradiating a line which extends along a width direction of said path with a slit ray;

an image capturing part for photographing said line to obtain an image;
a line data generator for generating one-dimensional line data indicative of an irradiation state of said slit ray on said line from the image obtained by said image capturing part;

a detection part for detecting said passing objects on the basis of said one-dimensional line data;

a counter for counting said number of said passing objects on the basis of said line data detected by said detection part; and

an interruption data generator for comparing said line data with reference data indicative of a state of said line when said slit ray is not interrupted and generating one-dimensional interruption data indicative of a position in which said slit ray is interrupted on said line. The counting system according to claim 7,

wherein in said interruption data, a value of a pixel which serves as data in each of

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positions on said line is expressed by two values of a first value indicating that said slit ray is interrupted and a second value indicating that said slit ray is not interrupted, and

wherein said counter counts said number of said passing objects on the basis of said interruption data.

10. (Original) The counting system according to claim 9, wherein said passing object is a person, and said counting system further comprises an extractor for extracting a group of pixels which are continuous with respect to position, each of which has said first value, and of which number exceeds a first reference value in said interruption data, as information indicative of said person on said line.

11. (Original) The counting system according to claim 9, further comprising: a changing part for changing a value of a group of pixels which are continuous with respect to position, each of which has said second value, and of which number is less than a second reference value in said interruption data, to said first value.

12. (Currently Amended) The counting system according to claim [[7]] 9, wherein

said line is photographed in predetermined time cycles and said line data is generated in said predetermined time cycles from images obtained by the photographing, and

said counting system further comprises an updating part for updating said reference data on the basis of a predetermined number of pieces of said line data generated most recently.

13. (Currently Amended) The counting system according to claim [[7]] 9, wherein

said line is photographed in predetermined time cycles and said interruption data is generated in said predetermined time cycles from images obtained by the photographing, and

said counting system further comprises:

an image generator for generating time-series images each by connecting a predetermined number of pieces of said interruption data generated most recently in accordance with generation time; and

a display for displaying said time-series images.

14. (Original) The counting system according to claim 1, wherein
said passing object is a person, and
said slit ray is an invisible ray.

15. (Original) The counting system according to claim 2, wherein
said passing object is a person, and
said slit ray is an invisible ray.

16. (Currently Amended) A method of counting the number of passing objects in a path, comprising the steps of:

- (a) photographing a line which extends along a width direction of said path while irradiating said line with a slit ray;
- (b) generating one-dimensional line data indicative of an irradiation state of said slit ray on said line from an image obtained in the step (a);
- (c) detecting said passing objects on the basis of said one-dimensional line data; and
- (d) counting said number of said passing objects on the basis of said line data detected in step (c),

wherein said one-dimensional line data is generated by selecting a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and said statistical representative value is set as a value of a pixel in said line data in the same position as each pixel column.

17. (Currently Amended) A method of counting the number of passing objects in a path, comprising the steps of:

- (a) photographing a plurality of lines which extend along the width direction of said path and provided at intervals, respectively, while irradiating said plurality of lines with a plurality of slit rays;
- (b) generating a plurality of pieces of one-dimensional line data each indicative of an irradiation state of each of said slit rays on said plurality of lines, respectively, from an image images obtained in the step (a);
- (c) detecting said passing objects on the basis of said plurality of pieces of one-dimensional line data; and
- (d) determining travel directions of said passing objects on the basis of said plurality of pieces of one-dimensional line data, and counting said number of said passing objects detected in step (c) in each of the travel directions of said passing objects,

wherein each of said plurality of pieces of one-dimensional line data is generated by selecting a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and said statistical representative value is set as a value of a pixel in said line data in the same position as each pixel column.

18. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:

- a light emitter for making a slit ray image and for irradiating a line which extends along a width direction of said path with a slit ray;
 - an image capturing part for photographing said line to obtain a slit ray image data;
 - a line data generator for generating one-dimensional line data indicative of an irradiation state of said slit ray image from said slit ray image data obtained by said image capturing part; and
 - a counter for counting said number of said passing objects on the basis of said one-dimensional line data,
- wherein said slit ray image breaks in a position in which the slit ray is interrupted

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by the passing objects, and

wherein said line data generator selects a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and sets said statistical representative value as a value of a pixel in said line data in the same position as each pixel column.

19. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:

a light emitter for making a plurality of slit ray images and for irradiating a plurality of lines which extend along a width direction of said path and provided at intervals, respectively, with a plurality of slit rays;

an image capturing part for photographing said plurality of lines to obtain a plurality of pieces of slit ray image data;

a line data generator for generating a plurality of pieces of one-dimensional line data indicative of an irradiation state of each of said slit ray images, respectively, from said plurality of pieces of slit ray image data obtained by said image capturing part; and

a counter for determining travel direction of said passing objects on the basis of said plurality of pieces of said slit ray image data and for counting said number of said passing objects in each of the traveling directions of said passing objects,

wherein said slit ray images break in a position in which the slit ray is interrupted by the passing objects, and

wherein said line data generator selects a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and sets said statistical representative value as a value of a pixel in said line data in the same position as each pixel column.

20. (Currently Amended) A method of counting the number of passing objects in a path, comprising the steps of:

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(a) photographing a slit ray image on a line which extends along a width direction of said path to obtain a slit ray image data while irradiating said line with a slit ray;

(b) generating one-dimensional line data indicative of an irradiation state of said slit ray image from a slit ray image data obtained in the step (a); and

(c) counting said number of said passing objects on the basis of said one-dimensional line data,

wherein said slit ray image breaks in a position in which the slit ray is interrupted by the passing objects, and

wherein said one-dimensional line data is generated by selecting a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and said statistical representative value is set as a value of a pixel in said line data in the same position as each pixel column.

21. (Previously Presented) A method of counting the number of passing objects in a path, comprising the steps of:

(a) photographing a plurality of slit ray images on lines which extend along the width direction of said path and provided at intervals to obtain a plurality of slit ray image data, respectively, while irradiating said plurality of lines with a plurality of slit rays;

(b) generating a plurality of pieces of one-dimensional line data each indicative of an irradiation state of each of said slit ray images on said plurality of lines, respectively, from slit ray image data obtained in the step (a); and

(c) determining travel directions of said passing objects on the basis of said plurality of pieces of one-dimensional line data, and counting said number of said passing objects in each of the travel directions of said passing objects,

wherein said slit ray images break in a position in which the slit ray is interrupted by said passing objects, and

wherein each of said plurality of pieces of one-dimensional line data is generated by selecting a statistical representative value from values of pixels of each pixel column

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arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and said statistical representative value is set as a value of a pixel in said line data in the same position as each pixel column.

22. (Previously Presented) A counting system for counting the number of passing objects in a path, comprising:

a light emitter for irradiating a line which extends along a width direction of said path with a slit ray;

an image capturing part for photographing said line to obtain an image;

a line data generator for generating one-dimensional line data indicative of an irradiation state of said slit ray on said line from the image obtained by said image capturing part; and

a counter for counting said number of said passing objects on the basis of said line data,

wherein said line data generator selects a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and sets said statistical representative value as a value of a pixel in said line data in the same position as each pixel column.

23. (Previously Presented) A counting system for counting the number of passing objects in a path, comprising:

a light emitter for irradiating a plurality of lines which extend along a width direction of said path and provided at intervals, respectively, with a plurality of slit rays;

an image capturing part for photographing said plurality of lines to obtain images;

a line data generator for generating a plurality of pieces of one-dimensional line data each indicative of an irradiation state of each of said slit rays on said plurality of lines, respectively, from the images obtained by said image capturing part; and

a counter for determining travel directions of said passing objects on the basis of said plurality of pieces of line data, and counting said number of said passing objects in

each of the traveling directions of said passing objects,

wherein said line data generator selects a statistical representative value from values of pixels of each pixel column arranged in a second direction orthogonal to a first direction corresponding to a direction of said line in said image, and sets said statistical representative value as a value of a pixel in said line data in the same position as each pixel column.

24. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:

a light emitter for irradiating a line which extends along a width direction of said path with a slit ray;

an image capturing part for photographing said line to obtain an image;

a line data generator for generating one-dimensional line data indicative of an irradiation state of said slit ray on said line from the image obtained by said image capturing part;

an interruption data generator for comparing said line data with reference data indicative of a state of said line when said slit ray is not interrupted and generating one-dimensional interruption data indicative of a position in which said slit ray is interrupted on said line; and

a counter for counting said number of said passing objects on the basis of said interruption data,

wherein in said interruption data, a value of a pixel which serves as data in each of positions on said line is expressed by two values of a first value indicating that said slit ray is interrupted and a second value indicating that said slit ray is not interrupted.

25. (Currently Amended) A counting system for counting the number of passing objects in a path, comprising:

a light emitter for irradiating a plurality of lines which extend along a width direction of said path and provided at intervals, respectively, with a plurality of slit rays;

an image capturing part for photographing said plurality of lines to obtain images;

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a line data generator for generating a plurality of pieces of one-dimensional line data each indicative of an irradiation state of each of said slit rays on said plurality of lines, respectively, from the images obtained by said image capturing part;

an interruption data generator for comparing said plurality of pieces of one-dimensional line data with reference data indicative of a state of said lines when said slit ray is not interrupted and generating a plurality of one-dimensional interruption data indicative of a position in which each of said slit ray is interrupted on said lines, and

a counter for determining travel directions of said passing objects on the basis of said interruption data, and counting said number of said passing objects in each of the traveling directions of said passing objects on the basis of said interruption data,

wherein in said interruption data, a value of a pixel which serves as data in each of positions on said line is expressed by two values of a first value indicating that said slit ray is interrupted and a second value indicating that said slit ray is not interrupted.